

- 1 1. An electro-absorption modulator comprising a semiconductor layer having an
2 electrically controllable absorption, a material composition of the semiconductor
3 layer being chosen so that the semiconductor layer is substantially transparent to
4 light propagating through the semiconductor layer when a substantially zero or a
5 reverse bias voltage is applied across the semiconductor layer at operating
6 temperatures of the electro-absorption modulator that are substantially greater
7 than 25 degrees Celsius.
- 1 2. The electro-absorption modulator of claim 1 wherein the semiconductor layer
2 comprises a multi-quantum well layer.
- 1 3. The electro-absorption modulator of claim 1 wherein the semiconductor layer
2 comprises a bulk semiconductor layer.
- 1 4. The electro-absorption modulator of claim 1 wherein a wavelength of the light
2 propagating through the semiconductor layer is substantially 1310nm.
- 1 5. The electro-absorption modulator of claim 1 wherein a wavelength of the light
2 propagating through the semiconductor layer is substantially 1550nm.
- 1 6. The electro-absorption modulator of claim 1 wherein the material composition of
2 the semiconductor layer is chosen so that the semiconductor layer is substantially
3 transparent to light propagating through the semiconductor layer when a
4 substantially zero or a reverse bias voltage is applied across the semiconductor
5 layer at operating temperatures of the electro-absorption modulator that are
6 substantially greater than 35 degrees Celsius.
- 1 7. The electro-absorption modulator of claim 1 wherein the material composition of
2 the semiconductor layer is chosen so that the semiconductor layer is substantially
3 transparent to light propagating through the semiconductor layer when a
4 substantially zero or a reverse bias voltage is applied across the semiconductor
5 layer at operating temperatures of the electro-absorption modulator that are

substantially greater than 45 degrees Celsius.

8. The electro-absorption modulator of claim 1 wherein the material composition of the semiconductor layer is chosen so that the semiconductor layer is substantially transparent to light propagating through the semiconductor layer when a substantially zero or a reverse bias voltage is applied across the semiconductor layer at a maximum operating temperature of one of the electro-absorption modulator or a laser that generates the light.

9. The electro-absorption modulator of claim 1 further comprising an electronic data modulator having an output that is electrically coupled to a modulation input of the electro-absorption modulator, the electronic data modulator generating an electrical AC modulation signal having a peak-to-peak voltage amplitude that changes an absorption edge of the semiconductor layer, thereby changing light transmission characteristics of the electro-absorption modulator.

10. The electro-absorption modulator of claim 9 further comprising a thermal sensor that is in thermal communication with at least one of the semiconductor layer of the electro-absorption modulator and a laser that generates the light.

11. The electro-absorption modulator of claim 10 further comprising a temperature-driven controller having an input that is electrically coupled to the thermal sensor and an output that is electrically coupled to a DC bias voltage control input of the electronic data modulator, the temperature-driven controller generating a signal that causes the electronic data modulator to change a DC bias voltage of the electrical AC modulation signal.

12. The electro-absorption modulator of claim 11 wherein the temperature-driven controller includes a processor that uses a look-up table to determine the DC bias voltage.

13. An electro-absorption modulated laser comprising:

a) a laser that generates light at an output; and

3 b) an electro-absorption modulator comprising a semiconductor layer that is
4 optically coupled to the output of the laser, the semiconductor layer
5 having an electrically controllable absorption, a material composition of
6 the semiconductor layer being chosen so that the semiconductor layer is
7 substantially transparent to light propagating through the semiconductor
8 layer when a substantially zero or a reverse bias voltage is applied across
9 the semiconductor layer at operating temperatures of the electro-
10 absorption modulator that are substantially greater than 25 degrees
11 Celsius.

1 14. The electro-absorption modulated laser of claim 13 wherein the semiconductor
2 layer of the electro-absorption modulation comprises a multi-quantum well layer.

1 15. The electro-absorption modulated laser of claim 13 wherein the laser comprises a
2 distributed feedback semiconductor laser.

1 16. The electro-absorption modulated laser of claim 13 wherein the laser and the
2 electro-absorption modulator are integrated onto a single substrate.

1 17. The electro-absorption modulated laser of claim 13 wherein the laser and the
2 electro-absorption modulator are physically separate devices that are optically
3 coupled.

1 18. The electro-absorption modulated laser of claim 13 further comprising a
2 thermoelectric cooler that is in thermal communication with the laser.

1 19. The electro-absorption modulated laser of claim 18 wherein the thermoelectric
2 cooler adjusts the temperature of the laser to change a wavelength of the light
3 generated by the laser.

1 20. The electro-absorption modulated laser of claim 13 wherein a wavelength of the
2 light generated by the laser is substantially 1310nm.

1 21. The electro-absorption modulated laser of claim 13 wherein a wavelength of the
2 light generated by the laser is substantially 1550nm.

1 22. The electro-absorption modulated laser of claim 13 wherein a voltage sensitivity
2 with respect to wavelength of the electro-absorption modulator is substantially
3 the same as a voltage sensitivity with respect to wavelength of the laser.

1 23. The electro-absorption modulated laser of claim 13 wherein the material
2 composition of the semiconductor layer of the electro-absorption modulator is
3 chosen so that the semiconductor layer is substantially transparent to light
4 propagating through the semiconductor layer when a substantially zero or a
5 reverse bias voltage is applied across the semiconductor layer at operating
6 temperatures of the electro-absorption modulator that are substantially greater
7 than 35 degrees Celsius.

1 24. A transmitter for an optical communication system, the transmitter comprising:

- 2 a) a laser that generates light at an output;
- 3 b) an electro-absorption modulator having an electrically controllable
4 absorption, the electro-absorption modulator comprising a semiconductor
5 layer that is optically coupled to the output of the laser, a material
6 composition of the semiconductor layer being chosen so that the
7 semiconductor layer is substantially transparent to light propagating
8 through the semiconductor layer when a substantially zero or a reverse bias
9 voltage is applied across the semiconductor layer at operating
10 temperatures of the electro-absorption modulator that are substantially
11 greater than 25 degrees Celsius;
- 12 c) an electronic data modulator having an output that is electrically coupled
13 to a modulation input of the electro-absorption modulator, the electronic
14 data modulator generating an AC electrical modulation signal having a
15 peak-to-peak voltage amplitude that changes an absorption edge of the
16 semiconductor layer, thereby changing light transmission characteristics
17 of the electro-absorption modulator and modulating the light generated by
18 the laser;

19 d) a thermal sensor that is in thermal communication with at least one of the
20 semiconductor layers of the electro-absorption modulator and the laser;
21 and

22 e) a temperature-driven controller having an input that is electrically coupled
23 to the thermal sensor and an output that is electrically coupled to a DC
24 bias control input of the electronic data modulator, the temperature-driven
25 controller generating a signal that causes the electronic data modulator to
26 change a DC bias voltage of the electrical AC modulation signal.

1 25. The transmitter of claim 24 wherein a wavelength of the light generated by the
2 laser is substantially 1310nm.

1 26. The transmitter of claim 24 wherein a wavelength of the light generated by the
2 laser is substantially 1550nm wavelength.

1 27. The transmitter of claim 24 wherein a voltage sensitivity with respect to
2 wavelength of the electro-absorption modulator is substantially the same as a
3 voltage sensitivity with respect to wavelength of the laser.

1 28. The transmitter of claim 24 wherein the material composition of the
2 semiconductor layer of the electro-absorption modulator is chosen so that the
3 semiconductor layer is substantially transparent to light propagating through the
4 semiconductor layer when a substantially zero or a reverse bias voltage is applied
5 across the semiconductor layer at operating temperatures of the electro-absorption
6 modulator that are substantially greater than 45 degrees Celsius.

1 29. A method of generating data modulated light, the method comprising:

2 a) generating light;

3 b) propagating the light through a semiconductor layer having an electrically
4 controllable absorption, a material composition of the semiconductor layer
5 being chosen so that the semiconductor layer is substantially transparent
6 to light propagating through the semiconductor layer when a substantially

7 zero or a reverse bias voltage is applied across the semiconductor layer at
8 operating temperatures of the electro-absorption modulator that are
9 substantially greater than 25 degrees Celsius;

10 c) elevating the temperature of the semiconductor layer above 25 degrees
11 Celsius;

12 d) applying a DC reverse bias voltage across the semiconductor layer; and

13 e) applying an AC electrical modulation signal having a peak-to-peak
14 voltage amplitude across the semiconductor layer, the modulation signal
15 changing an absorption edge of the semiconductor layer, thereby
16 modulating the light.

1 30. The method of claim 29 further comprising:

2 a) measuring a temperature of at least one of the semiconductor layers and a
3 laser that generates the light; and

4 b) changing the DC reverse bias voltage across the semiconductor layer in
5 response to the measured temperature.

1 31. The method of claim 29 further comprising:

2 a) measuring a temperature of at least one of the semiconductor layers and a
3 laser that generates the light; and

4 b) changing a bias current driving a laser that generates the light in response
5 to the measured temperature.

1 32. A method of tracking a temperature of an electro-absorption modulator to a
2 temperature of a semiconductor laser, the method comprising:

3 a) generating light with a semiconductor laser;

4 b) propagating the light through an electro-absorption modulator comprising

5 a semiconductor layer having an electrically controllable absorption, a
6 material composition of the semiconductor layer being chosen so that the
7 semiconductor layer is substantially transparent to light propagating
8 through the semiconductor layer when a substantially zero or a reverse bias
9 voltage is applied across the semiconductor layer at operating
10 temperatures of the electro-absorption modulator that are substantially
11 greater than 25 degrees Celsius;

- 12 c) applying an AC modulation signal having a DC reverse bias voltage and a
13 peak-to-peak voltage amplitude across the semiconductor layer, the
14 modulation signal changing an absorption edge of the semiconductor
15 layer, thereby changing light transmission characteristics of the electro-
16 absorption modulator and modulating the light generated by the laser;
- 17 d) measuring a temperature of the semiconductor laser that generates the
18 light; and
- 19 e) changing at least one of the DC reverse bias voltage and the peak-to-peak
20 voltage amplitude of the electrical modulation signal, and a bias current
21 through the laser in response to the measured temperature.